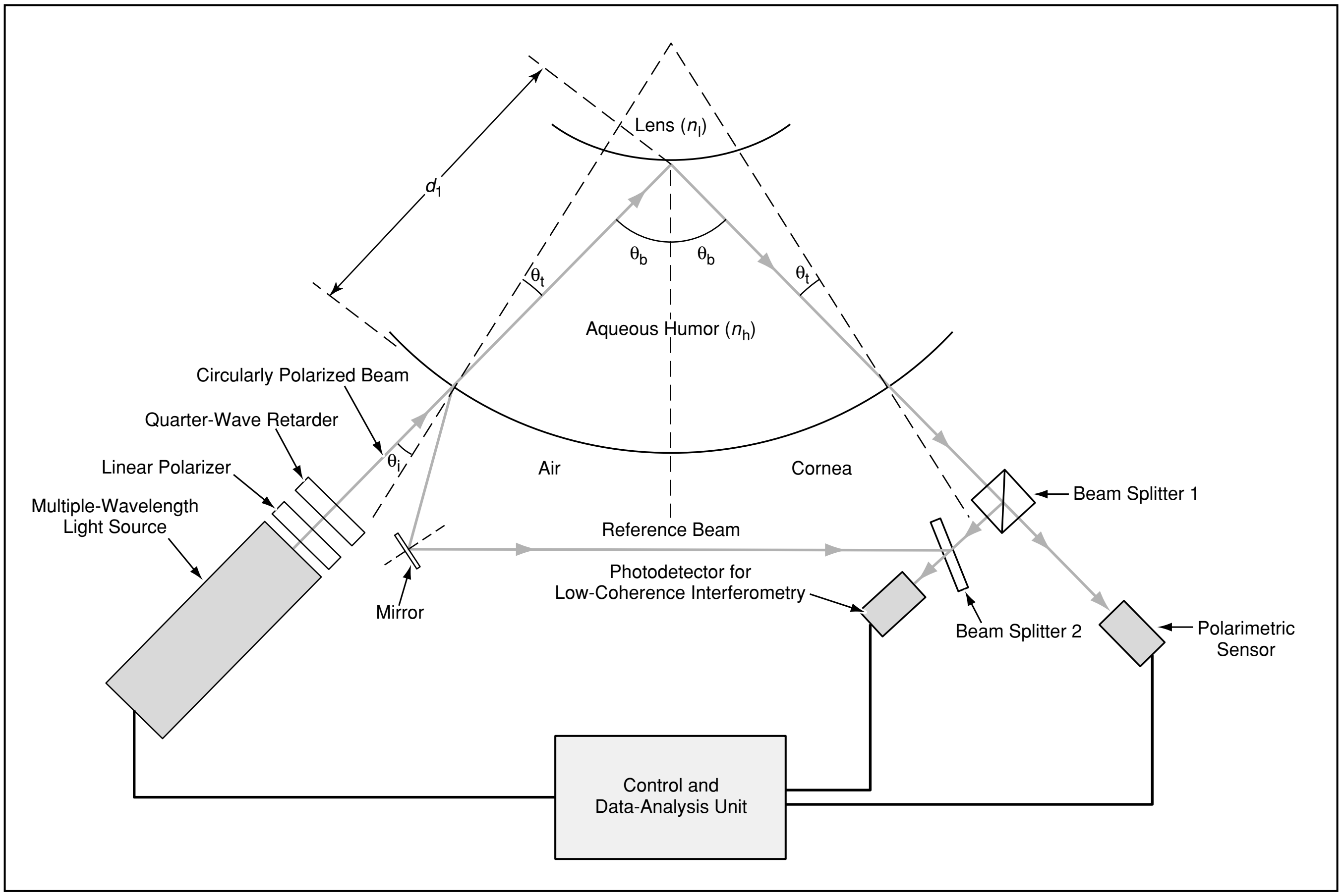


Light Beams Are Reflected and Transmitted by several components of the eye. The polarimetric and interferometric properties of the reflected and transmitted beams contain information on the concentration of glucose in the aqueous humor.

measures its angle of polarization. From this angle and the known orientation of the plane of incidence on the lens, the rotation angle can be determined. Part of the probe beam leaving the eye is reflected from beam splitter 1 toward beam splitter 2, wherein it is combined with the reference beam. The combination of the probe reference beams impinges on a photodetector for use in low-coherence interferometry to measure the total length of the path of the probe beam through the aqueous humor. By virtue of symmetry, half of this path length contributes to the measured rotation and is, therefore, the length to use in calculating the concentration of glucose.

As described thus far, the principle of operation does not necessarily involve the use of multiple wavelengths. The value of multiwavelength operation lies in the possibility of compensating for rotation caused by analytes other than glucose. By measuring at a number of wavelengths equal to the number of analytes (including glucose) that contribute to rotation and knowing the wavelength-dependent specific rotation, one can solve the system of linear equations for the rotation at the various wavelengths to extract the concentration of glucose (and, incidentally, of the other analytes).

This work was done by Rafat R. Ansari of **Glenn Research Center** *and Luigi L. Rovati of the University of Brescia. Further information is contained in a TSP [see page 1].*

Inquiries concerning rights for the commercial use of this invention should be addressed to NASA Glenn Research Center, Commercial Technology Office, Attn: Steve Fedor, Mail Stop 4–8, 21000 Brookpark Road, Cleveland, Ohio 44135. Refer to LEW-17216.

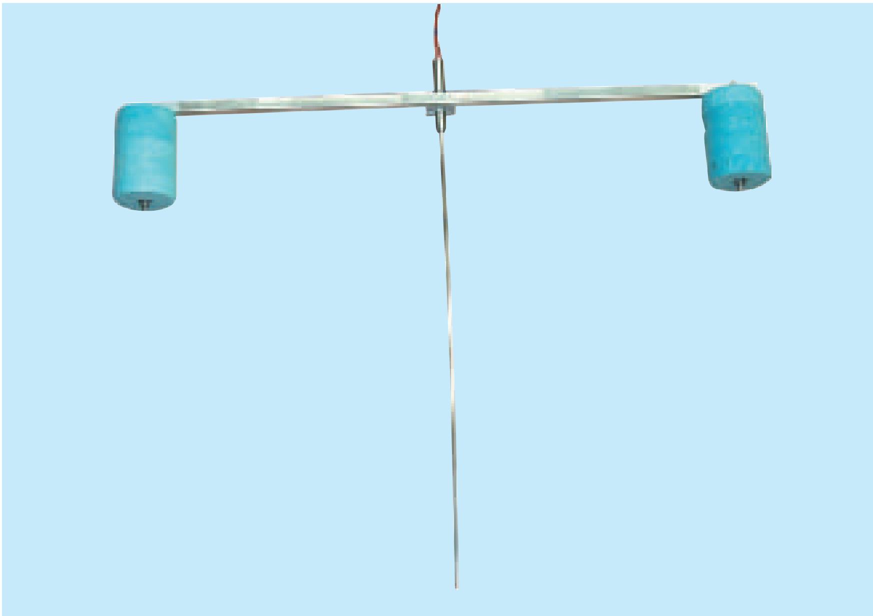
Floating Probe Assembly for Measuring Temperature of Water

Temperatures are measured at several depths.

Stennis Space Center, Mississippi

A floating apparatus denoted a temperature probe aquatic suspension system (TPASS) has been developed for measuring the temperature of an ocean, lake, or other natural body of water at predetermined depths. These types of measurements are used in computer models to relate remotely sensed water-surface temperature to bulk-water temperature. Prior instruments built for the same purpose were found to give inaccurate readings because the apparatuses themselves significantly affected the temperatures of the water in their vicinities. The design of the TPASS is intended to satisfy a requirement to minimize the perturbation of the temperatures to be measured.

The TPASS (see figure) includes a square-cross-section aluminum rod 28 in. (≈71 cm) long with floats attached at both ends. Each float includes five polystyrene foam disks about 3/4 in. (≈1.9 cm) thick and



This **Temperature-Probe Assembly** floats on a body of water. The metal sleeve at the middle hangs down into the water. Temperature probes are mounted inside the sleeve for measuring temperatures at several different depths.

2.5 in. (≈6.4 cm) in diameter. The disks are stacked to form cylinders, bolted to the rod, and covered with hollow plastic sleeves. A metal sleeve is clamped to the middle of the aluminum rod, from whence it hangs down into the water. Temperature probes (which can be thermocouples, thermistors, or resistance temperature devices) are placed within the sleeve at the desired measurement depths. Wires from the temperature probes are routed to the input terminals of a data logger.

This work was done by Randy Stewart of Lockheed Martin Corp. and Clyde Ruffin of GB Tech, Inc., for **Stennis Space Center**. *Further information is contained in a TSP* *[see page 1].*

Inquiries concerning rights for the commercial use of this invention should be addressed to the Intellectual Property Manager, Stennis Space Center *[see page 1].* *Refer to SSC-00136.*

Proton Collimators for Fusion Reactors

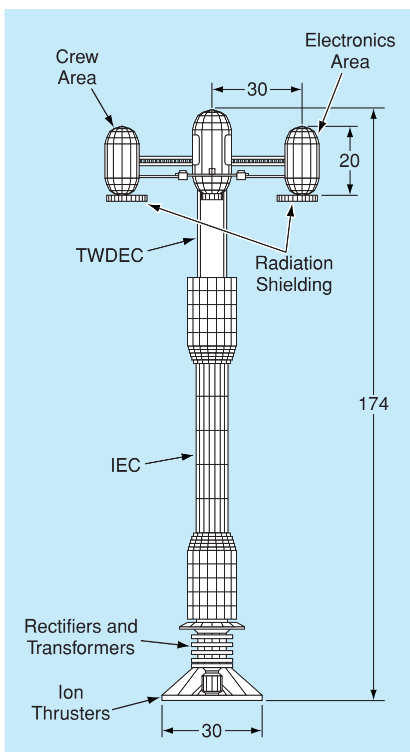
High-energy protons would be channeled into useful beams.

Marshall Space Flight Center, Alabama

Proton collimators have been proposed for incorporation into inertial-electrostatic-confinement (IEC) fusion reactors. Such reactors have been envisioned as thrusters and sources of electric power for spacecraft and as sources of energetic protons in commercial ion-beam applications. An artist's concept for an IEC powered spaceship designed for round trip missions to Mars and Jupiter is shown in the figure.

An IEC fusion reactor typically contains a plasma of pure ^{2}H or a ^{2}H-^{3}He mixture. Collisions among the ^{2}H and/or ^{3}He nuclei give rise to fusion reactions, the main energetic products of which are protons with kinetic energy ≈14 MeV and an isotropic velocity distribution. A proton collimator would collect the isotropically emitted protons and form them into a collimated beam.

A proton collimator would include (1) an electromagnet outside the fusion reactor that would impose a substantially uniform magnetic field within the reactor and (2) a pair of electromagnet coils inside the reactor, oriented to generate magnetic fields antiparallel to the one generated by the external electromagnet. The interior electromagnet coils would be positioned so that the fusion reaction would be concentrated in a region between them. The currents in the interior electromagnet coils would be adjusted to minimize the net magnetic field in the fusion-reaction region in order to avoid any adverse effect of the magnetic field on the trajectories of the ^{2}H-^{3}He ions that must collide to cause fusion reactions. The accessible region for the ions and electrons can be completely separated from inner electromagnet coils and support the structure, preventing bombardment damage.



A scale schematic of **100-MWe IEC Fusion-Powered Spacecraft** is depicted with dimensions in meters. (Note TWDEC = Traveling-Wave Direct Energy Converter.)

The overall effect of the electromagnets would be to channel the isotropically emitted 14-MeV protons into a beam substantially parallel to the magnetic field. The collimator would also separate the 14-MeV protons from unreacted fuel ions leaking out of the reaction region. The leaking fuel constituents would be collected on plates, condensed to a gas, pumped out, and recycled to the reactor.

The collimated proton beam could be used directly for spacecraft thrust or an industrial ion-beam application. Alternatively, the proton collimator would be used in conjunction with a magnetic expander and an electron/ion separator to generate a net electric current. Another approach under consideration for space propulsion is to focus the beam on a target, e.g., a small plastic pellet, which would be vaporized and exhausted through a magnetic nozzle. Yet another alternative is to introduce the beam into a highly efficient traveling-wave energy-conversion device to extract electric power.

This work was done by George H. Miley and Hiromu Momota of NPL Associates, Inc., for **Marshall Space Flight Center**. *Further information is contained in a TSP* *[see page 1].* *MFS-31734*